



Legislative Council Staff

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Memorandum

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TO: Interested Persons

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SUBJECT: Regulatory Framework for Greenhouse Gas Emissions Reductions

Summary

Greenhouse gas emissions have been identified by the global scientific community as the major driver of climate change.¹ Globally, countries are committing to reduce greenhouse gas emissions to combat the effects of climate change. This memorandum provides background on the policies and programs related to greenhouse gas emissions reductions at the national, regional, and state levels within the United States.

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Background on Greenhouse Gases

Greenhouse gases trap heat in the atmosphere by absorbing radiation, thereby increasing global temperatures. The major greenhouse gases emitted through human activities are carbon dioxide, nitrous oxide, methane, and several fluorinated gases (e.g., hydrofluorocarbons). Although some of these gases are naturally occurring in the atmosphere (e.g., carbon dioxide), human activities have significantly increased their atmospheric concentrations. Human activities that contribute to greenhouse gas emissions include the burning of fossil fuels, oil and natural gas resource development, agriculture, waste management, and industrial processes.

Greenhouse gases emitted by human activities are estimated to have increased the earth's mean surface temperature by approximately 1 degree Celsius above pre-industrial levels (circa 1750), and are likely to reach an increase of 1.5 degrees Celsius by 2052 if current trends continue, according to the Intergovernmental Panel on Climate Change. The warming of earth's temperature is changing the climate in ways that affect human health, safety, and well-being, including:

¹Intergovernmental Panel on Climate Change, 2014. Climate Change 2014: Synthesis Report.

- increased risk from extreme temperatures, including heat-related morbidity and mortality;
- increased water-related risks from droughts and flooding;
- sea level rise caused by melting ice sheets, affecting coastal communities;
- terrestrial species loss and extinction;
- increased ocean temperatures and acidification, resulting in losses of marine resources; and
- food insecurity related to declining crop yields.

National Policies

A number of countries have committed to reducing greenhouse gas emissions. Although the United States has yet to commit to national greenhouse gas reduction targets, several acts direct agencies to promulgate regulations, programs, and standards that address greenhouse gas mitigation.² Several examples are listed below.

- The [Clean Air Act](#) requires the U.S. Environmental Protection Agency (EPA) to regulate greenhouse gas emissions.
- The [Energy Independence and Security Act of 2007](#) requires the EPA and U.S. Department of Transportation to regulate greenhouse gas emissions by establishing fuel economy standards in motor vehicles.
- The [Energy Policy Act of 2005](#) establishes a number of programs on energy efficiency and renewable energy.
- The [American Recovery and Reinvestment Act of 2009](#) provides funding for measures advancing energy independence and renewable energy technologies.

In 2009, the EPA promulgated rules that require facilities that emit greenhouse gases above a certain threshold to report their emissions annually through the [Greenhouse Gas Reporting Program](#). To date, approximately 8,000 facilities report annual emissions, accounting for approximately 85 percent of total greenhouse gas emissions in the United States. In Colorado, 119 facilities reported greenhouse gas emissions in 2017, which accounted for 47 million metric tons of carbon dioxide.

Sub-national Policies

As of September 2019, 22 states including Colorado, plus Washington, D.C., have adopted greenhouse gas emissions reduction targets.³ In addition, ten states have imposed carbon pricing regulations through market-based, cap-and-trade programs. Cap-and-trade programs set a limit, or cap, on greenhouse gas emissions, and allow regulated entities to purchase and trade allowances that enable the regulated entities to emit a set amount of greenhouse gases. The two cap-and-trade programs in the United States are described below.

²The United States submitted intended nationally determined contributions to the United Nations Framework Convention on Climate Change, in accordance with the Paris Agreement, adopted in 2015, which established targets to reduce emissions by 26-28 percent below 2005 levels by 2025, and to make best efforts to reduce its emissions by 28%. However, in 2017, the United States announced its intent to withdraw from the Paris Agreement. <https://unfccc.int/news/unfccc-statement-on-the-us-decision-to-withdraw-from-paris-agreement>

³Center for Climate and Energy Solutions. State Climate Policy. <https://www.c2es.org/content/state-climate-policy/>

The [Regional Greenhouse Gas Initiative](#) (RGGI), established in 2005, operates a cooperative effort of nine Northeast and Mid-Atlantic states to cap and reduce carbon dioxide emissions from fossil fuel-fired electric power generators with a capacity of 25 megawatts (MW) or greater. The regional carbon emissions cap under the RGGI is adjusted each year to reflect the reduction in total emissions allowances. Allowances are distributed by auction (although a limited amount can be held in reserve), and are tradable on secondary markets. The RGGI has set a goal of reducing emissions 45 percent below 2005 levels by 2020, with an additional 30 percent reduction from 2020 to 2030.

[California's Cap-and-Trade program](#), signed into law in 2006, sets statewide limits on greenhouse gas emissions from approximately 450 sources responsible for 85 percent of California's emissions. The program regulates electricity generators, large industrial facilities, and fuel distributors. The program linked with the cap-and-trade program in Quebec, Canada, in 2014, and in Ontario starting in 2018. California has set a greenhouse gas emissions limit, equal to the 1990 level, to be achieved by 2020, and further reduces the statewide greenhouse gas emissions limit to 40 percent below the 1990 level by 2030.⁴

Colorado Policies

Statewide policies. Colorado has passed a series of measures to regulate greenhouse gas emissions. State law authorizes the Air Quality Control Commission (AQCC) in the Colorado Department of Public Health and Environment (CDPHE) to regulate greenhouse gas emissions. On October 21, 2010, the AQCC amended its regulations to address greenhouse gas in Colorado and established a definition of "greenhouse gas" that is the same as the EPA definition.⁵

Renewable portfolio standards. In 2004, Colorado enacted a renewable portfolio standard, which required qualifying retail utilities to obtain a minimum percentage of their power from eligible renewable energy sources such as wind, solar, hydropower, and geothermal.⁶ The standard required all Colorado utilities with 40,000 or more customers to generate or purchase 3 percent of their renewable energy by 2010, 6 percent by 2014, and 10 percent by 2015. Following passage of House Bill 10-1001, the renewable energy requirements increased to 30 percent for investor-owned utilities. Following passage of Senate Bill 13-252, the renewable energy requirements for cooperative utilities increased to 20 percent.

According to the U.S. Energy Information Administration, Colorado currently generates 25 percent of its electricity from nonhydroelectric renewable energy sources (e.g., wind and solar), as shown in Figure 1.

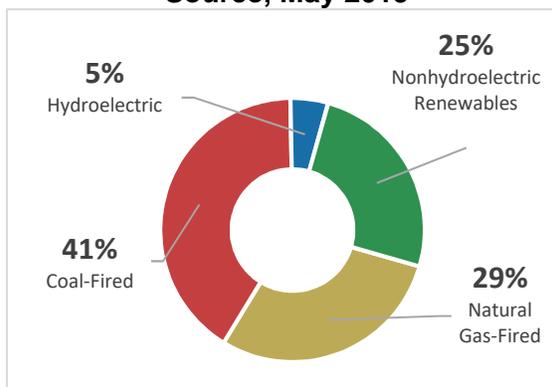
⁴California Air Resources Board. <https://ww2.arb.ca.gov/ghg-2020-limit>

⁵CCR 1001-5, Parts A, B, C, and D.

⁶Section 40-2-124, C.R.S.

Climate Action Plan. In 2011, under Governor Ritter, Colorado produced its first Climate Action Plan to address climate change in Colorado, which set a goal of reducing greenhouse gas emissions by 20 percent below 2005 levels by 2020. In 2013, House Bill 13-1293 directed the Governor to develop and periodically update a climate action plan that sets forth a strategy, including specific policy recommendations, to address the impacts of climate change and reduce greenhouse gas emissions. The bill also required annual reporting to the General Assembly on climate change issues in Colorado, including wildfires, pest infestation, snowpack, water storage, drought, and statewide greenhouse gas emissions. Revisions to the Colorado Climate Action Plan have been released in 2014 and 2018 and can be accessed at <http://cwcb.state.co.us/environment/climate-change/Pages/main.aspx>.

**Figure 1
Colorado Net Electricity Generation by Source, May 2019**



Source: United States Energy Information Administration, *Electric Power Monthly*.

Oil and natural gas emissions. In 2014, the AQCC fully adopted the EPA’s Standards of Performance for Crude Oil and Natural Gas Production, Transmission, and Distribution rules to reduce emissions in the oil and natural gas sector. The rules focus on identifying and repairing leaks in the oil and gas sector, and contain certain record-keeping and reporting requirements.

Regulated utilities. Colorado’s Clean Air - Clean Jobs Act, enacted in 2010, required all rate-regulated utilities that own or operate coal-fired electric generating units to submit an emissions reduction plan for emissions from those units to the Public Utilities Commission. The plans were required to cover a minimum of 900 megawatts or 50 percent of the utility’s coal-fired electric generating units in Colorado, whichever is smaller.⁷

Greenhouse gas reduction targets. In 2017, Governor Hickenlooper signed Executive Order [D 2017-015](#), committing the state to reduce greenhouse gas emissions by more than 26 percent from 2005 levels by 2025, and to reduce carbon dioxide emissions from the electricity sector by 25 percent by 2025 and 35 percent by 2030 from 2012 levels.

Municipal policies. In addition to statewide efforts to curb greenhouse gas emissions, local municipalities are setting their own targets and defining strategies to achieve them. Boulder’s Climate Action Plan (CAP), for instance, sets climate targets of 80 percent emissions reduction by 2050, and 100 percent renewable electricity by 2030. In 2006, Boulder voters approved the nation’s first tax dedicated to mitigating climate change. City residents and businesses pay a CAP tax on electricity consumption, which generates nearly \$2 million per year to fund policies, programs, and rebates to reduce greenhouse gas emissions.

⁷Section 40-3.2-201, *et seq.*, C.R.S.

Greenhouse Gas Reporting and Emissions Profile in Colorado

Greenhouse gas reporting. Greenhouse gas reporting requirements were first enacted in Colorado in 2008 with Executive Order D 004-08, issued by Governor Ritter. The Executive Order required CDPHE to report every five years on the estimates of greenhouse gas emissions by sector. The inventory assesses greenhouse gas emissions in the following sectors:

- agriculture;
- coal mining and abandoned mines;
- electric power generation;
- industrial processes;
- land use, land use change, and forestry;
- natural gas and oil systems;
- residential, commercial, and industrial fuel use;
- transportation; and
- waste management.

Global warming potential. Greenhouse gases have different global warming potentials based on their ability to absorb energy and how long the gas remains in the atmosphere (i.e., its lifetime). When reporting total greenhouse gas emissions in statewide inventories, it is therefore necessary to report emissions in carbon dioxide equivalents. For instance, methane has a global warming potential of 25 times that of carbon dioxide over a 100-year time horizon. Thus, methane emissions are multiplied by 25 when reporting emissions in carbon dioxide equivalent. Table 1 below lists the global warming potential of greenhouse gases accounted for in the Colorado greenhouse gas inventory.

Table 1
Global Warming Potentials (100-Year Time Horizon)

Gas	Global Warming Potential
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	25
Nitrous Oxide (N ₂ O)	298
Hydrofluorocarbons (HFC)	varies (124 - 14,800)
Perfluorocarbon (PFC)	varies (7,390 - 12,200)
Sulfur Hexafluoride (SF ₆)	22,800

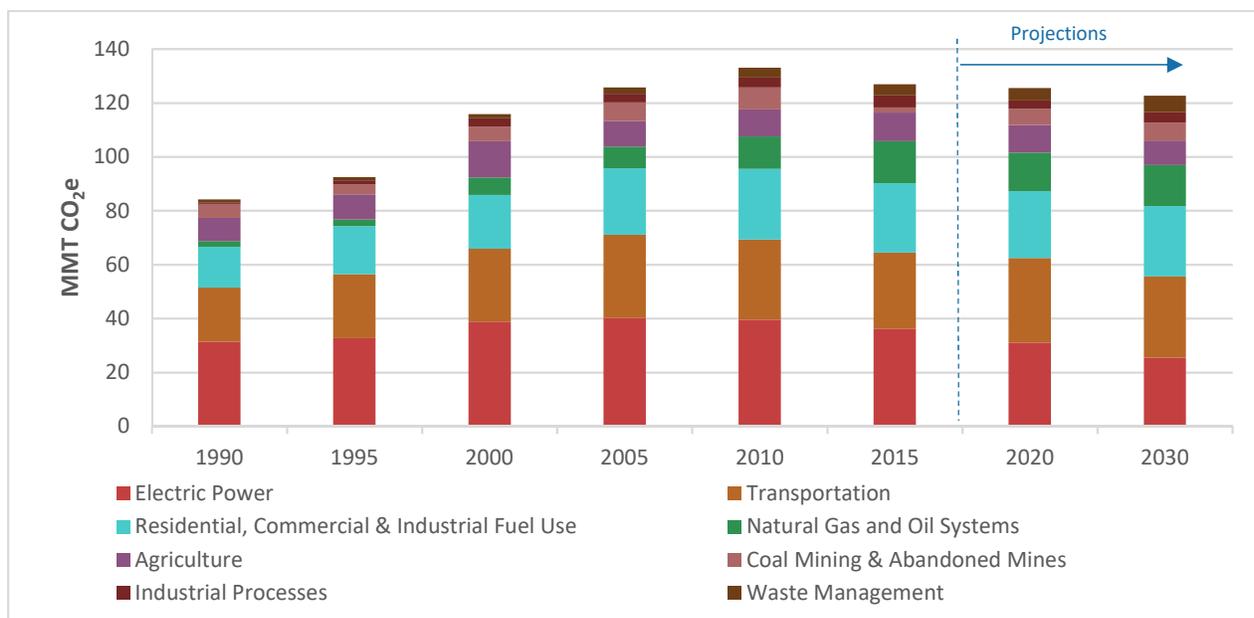
Source: IPCC Fourth Assessment Report (2007).

Colorado greenhouse gas inventory. The first Colorado inventory of greenhouse gas emissions was released in 2014, and a draft report has been issued for 2019. The inventory includes a comprehensive summary of greenhouse gas emissions estimates from 1990 to 2015, and emissions projections to 2020 and 2030. The inventory accounts for emissions and sinks, utilizing the EPA's State Inventory Tool that applies a top-down approach to calculating greenhouse gas emissions.

As shown in Figure 2, Colorado emitted about 127 million metric tons of carbon dioxide equivalent in 2015. Overall, emissions in Colorado increased from 1990 through 2010, then decreased between 2010 and 2015. Over half (51 percent) of Colorado's greenhouse gas emissions in 2015 came from the

combined impact of electric power plants and motor vehicles. Residential, commercial, and industrial fuel use comprised about 20 percent of greenhouse gas emissions, and natural gas and oil production accounted for 12 percent of emissions in 2015. The remainder of emissions come from the agriculture, mining, industrial, and waste management sectors, which comprise less than one-fifth of total greenhouse gas emissions.

Figure 2
Estimated Colorado Greenhouse Gas Emissions by Sector, 1990-2030
 Millions of Metric Tons of Carbon Dioxide Equivalent⁸

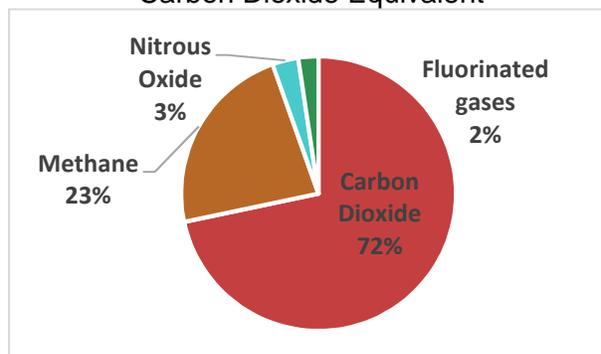


Source: Colorado Department of Public Health and Environment.

Emissions are projected to decline modestly in 2020 and 2030, largely driven by reductions in electric power, natural gas and oil systems, and industrial processes. Inventory projections are based on historic emissions and national projections on predicted activity data, and do not take into account recently enacted greenhouse gas reduction targets and strategies.

Figure 3 presents emissions according to greenhouse gas in 2015. Carbon dioxide accounted for nearly three-quarters (72 percent) of greenhouse gas emissions in 2015. Methane accounted for 23 percent, and nitrous oxide and fluorinated gases accounted for the remaining 5 percent.

Figure 3
Greenhouse Gas Emissions by Gas, 2015
 Carbon Dioxide Equivalent



Source: Colorado Department of Public Health and Environment.

⁸The Land Use, Land Use Change, and Forestry sector, not reflected here, is estimated to have sequestered 6.5 million metric tons of carbon dioxide equivalent in 2015, offsetting approximately 5% of total greenhouse gas emissions.

Recent Colorado Legislation

During the 2019 legislative session, several pieces of legislation were passed and signed into law that further specify the greenhouse gas emissions reduction goals in the state.

House Bill 19-1003 increases the maximum size of community solar gardens from 2 megawatts to 5 megawatts. The maximum size may further increase up to 10 megawatts beginning July 1, 2023, pending authorization from the PUC.

House Bill 19-1260 directs counties to meet or exceed building code energy standards by using one of the three most recent versions of the International Energy Conservation Code when adopting or updating building codes.

House Bill 19-1261 establishes statewide greenhouse gas emissions reduction goals aimed at limiting the increase in the global average temperature. The bill set statewide goals to reduce greenhouse gas emissions by at least 26 percent in 2025, by at least 50 percent in 2030, and by at least 90 percent in 2050 compared to 2005 levels. The AQCC is authorized to promulgate rules and regulations to achieve these emissions reduction goals, taking into account the costs and benefits of compliance, equitable distribution of reductions, clean energy incentives, and climate resiliency in Colorado's communities.

Senate Bill 19-077 authorizes electric public utilities to develop electric vehicle infrastructure as a measure to reduce statewide greenhouse gas emissions by 40 percent below 2005 levels by 2030 and 80 percent below 2005 levels by 2050.

Senate Bill 19-096 supports the state's efforts to meet its greenhouse gas emissions reduction targets and requires the AQCC to collect greenhouse gas emissions data and to update the statewide greenhouse gas inventory at least every two years. It also requires the commission to adopt rules that require monitoring and public reporting of greenhouse gas emissions by sector to support the statewide greenhouse gas emissions reduction goals.

Senate Bill 19-181 made various changes to the Colorado Oil and Gas Conservation Commission and its regulation of oil and natural gas development in the state. The bill shifted the mission of the commission to protecting public health and safety, removed state preemption of oil and gas regulation, and directed the commission to promulgate rules on wellhead integrity, flowlines, and shut-in wells. The bill also directs the AQCC to adopt rules to minimize emissions from natural gas systems, and to review leak detection and repair rules.

Senate Bill 19-236, which reauthorized the Public Utilities Commission (PUC) following a sunset review, made various changes to utility regulation. The bill requires the PUC to include the social cost of carbon in certain proceedings related to public utilities, and establishes a base social cost of carbon as no less than \$46 per ton of carbon dioxide.⁹ In addition, the bill requires qualifying retail utilities to formulate a clean energy plan that addresses how the utility plans to achieve greenhouse gas emissions reduction targets by 2030 and 2050.

⁹The social cost of carbon is the monetary value of the long-term damages caused by emitting one ton of carbon dioxide into the atmosphere in a given year. This monetary value includes damages to agricultural yields, human health, property, and energy costs. See: https://www.epa.gov/sites/production/files/2016-12/documents/social_cost_of_carbon_fact_sheet.pdf